



DECLARATION OF PERFORMANCE

for fischer injection system FIS EM Plus (Bonded fastener for use in concrete)

1. Unique identification code of the product-type: DoP 0173

2. Intended use/es: Post-installed fastening in cracked or uncracked concrete. See appendix, especially annexes

3. Manufacturer: fischerwerke GmbH & Co. KG, Otto-Hahn-Straße 15, 79211 Denzlingen, Germany

4. Authorised representative:

5. System/s of AVCP: 1

6. European Assessment Document: EAD 330499-01-0601 European Technical Assessment: ETA-17/0979; 2019-07-22

Technical Assessment Body: DIBt- Deutsches Institut für Bautechnik

Notified body/ies: 1343 MPA Darmstadt

7. Declared performance/s:

Mechanical resistance and stability (BWR 1)

Characteristic resistance to tension load (static and

quasi-static loading):

Annexes C1- C3 Resistance to steel failure:

Resistance to combined pull- out and concrete cone Annexes C5- C12 $\psi^0_{sus} = NPD$ failure:

Resistance to concrete cone failure: Annex C4

Edge distance to prevent splitting under load: Annex C4

Robustness: Annex C4

Annexes B3, B6- B8 Maximum installation torque:

Minimum edge distance and spacing: Annexes B3- B8

Characteristic resistance to shear load (static and

quasi-static loading):

Resistance to steel failure: Annexes C1- C3 Resistance to prv-out failure: Annex C4 Resistance to concrete edge failure: Annex C4

Characteristic resistance and displacements for

seismic performance categories C1 and C2:

Resistance to tension load, displacements, category

Resistance to tension load, displacements, category

Resistance to shear load, displacements, category

C1:

Resistance to shear load, displacements, category Annexes C15, C16, C18

NPD Factor annular gap:

Displacements under short-term and long-term

loading:

Displacements under short-term and long-term

Annexes C13, C14

Annexes C15- C16, C17

Annexes C15, C16, C18

Annexes C15- C16, C17

Hygiene, health and the environment (BWR 3)

Content, emission and/or release of dangerous

substances:

NPA

Fischer DATA DOP_ECs_V25.xlsm 1/2

ΕN





2/2

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Thilo Pregartner, Dr.-Ing.
Tumlingen, 2019-08-01

ppa. The Mx

Peter Schillinger, Dipl.-Ing.

i.V. P. Sot

This DoP has been prepared in different languages. In case there is a dispute on the interpretation the English version shall always prevail.

The Appendix includes voluntary and complementary information in English language exceeding the (language-neutrally specified) legal requirements.

Fischer DATA DOP_ECs_V25.xlsm

Specific Part

1 Technical description of the product

The "fischer injection system FIS EM Plus" is a bonded fastener consisting of a cartridge with injection mortar fischer FIS EM Plus and a steel element according to Annex A5.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance for static and quasi-static tension load	See Annex C 1 to C 12
Characteristic resistance for static and quasi-static shear load	See Annex C 1 to C 4
Displacements for static and quasi-static loads	See Annex C 13 to C 14
Characteristic resistance for seismic performance categories C1 and C2	See Annex C 15 to C 18
Durability	See Annex B 2

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

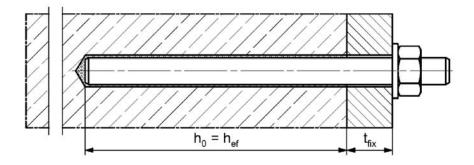
In accordance with EAD 330499-01-0601 according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

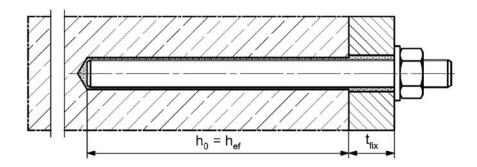
Installation conditions part 1

fischer anchor rod

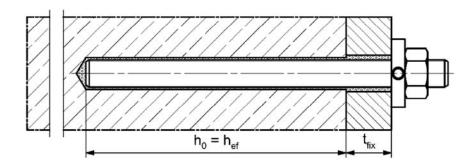
Pre-positioned installation



Push through installation (annular gap filled with mortar)



Pre-positioned or push through installation with subsequently injected filling disk (annular gap filled with mortar)



Figures not to scale

 h_0 = drill hole depth

h_{ef} = effective embedment depth

 t_{fix} = thickness of fixture

fischer injection system FIS EM Plus

Product description

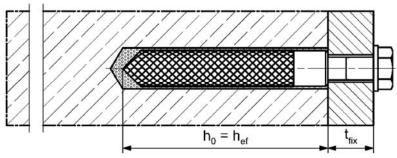
Installation conditions part 1

Annex A 1

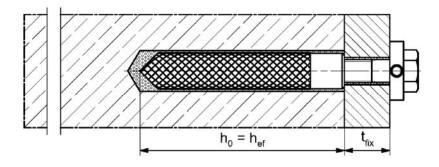
Installation conditions part 2

fischer internal threaded anchor RG MI

Pre-positioned installation



Pre-positioned installation with subsequently injected filling disk (annular gap filled with mortar)



Figures not to scale

 h_0 = drill hole depth

h_{ef} = effective embedment depth

 t_{fix} = thickness of fixture

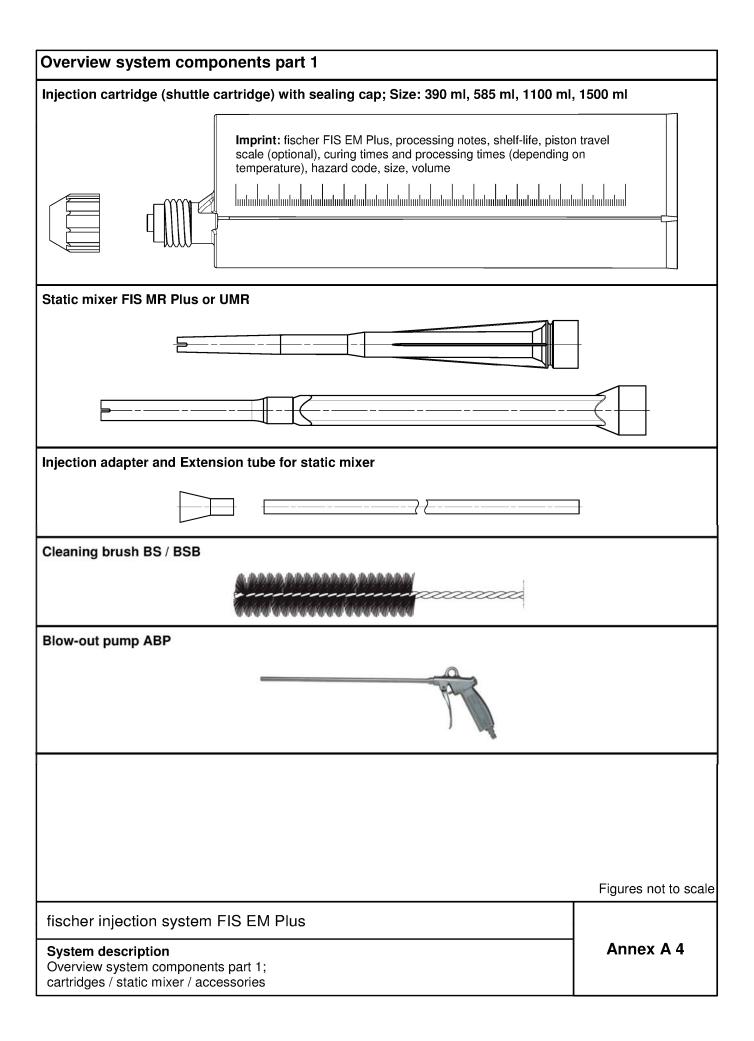
fischer injection system FIS EM Plus

Product description

Installation conditions part 2

Annex A 2

Installation conditions part 3 Reinforcing bar $h_0 = h_{ef}$ fischer rebar anchor FRA **Pre-positioned installation** h_0 Push through installation (annular gap filled with mortar) h_0 Figures not to scale h_0 = drill hole depth hef = effective embedment depth t_{fix} = thickness of fixture fischer injection system FIS EM Plus Annex A 3 **Product description** Installation conditions part 3



Overview system components part 2 fischer anchor rod Size: M8, M10, M12, M14, M16, M20, M22, M24, M27, M30 fischer internal threaded anchor RG MI Size: M8, M10, M12, M16, M20 Screw / threaded rod / washer / hexagon nut fischer filling disk FFD with injection adapter Reinforcing bar Nominal diameter: \$\phi 8\$, \$\phi 10\$, \$\phi 12\$, \$\phi 14\$, \$\phi 16\$, \$\phi 18\$, \$\phi 20\$, \$\phi 22\$, \$\phi 24\$, \$\phi 25\$, \$\phi 26\$, \$\phi 28\$, \$\phi 30\$, \$\phi 32\$, \$\phi 34\$, \$\phi 36\$, \$\phi 40\$ fischer rebar anchor FRA Size: M12, M16, M20, M24 Figures not to scale fischer injection system FIS EM Plus Annex A 5 System description Overview system components part 2;

steel components

Part	Designation		Material			
1	Injection cartridge		Mortar, hardener, filler			
	Steel grade	Steel, zinc plated	Stainless steel A4 1)	High corrosion resistant steel C ²⁾		
2	Anchor rod		Property class 50, 70 or 8 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; 1.4062, 1.4662, 1.4462; EN 10088-1:2014) $f_{uk} \le 1000 \text{ N/mm}^2$ $A_5 > 12\%$ fracture elongation $A_5 > 8 \%$, for applications we desimic performance catego	EN ISO 3506-1:2009 or property class 70 wing fyk= 560 N/mm² 1.4565; 1.4529; EN 10088-1:2014 fuk ≤ 1000 N/mm² $A_5 > 12\%$ fracture elongation without requirements		
3	Washer ISO 7089:2000	zinc plated ≥ 5 μm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 μm EN ISO 10684:2004	1.4401; 1.4404; 1.4578;1.4571; 1.4439; 1.4362; EN 10088-1:2014	1.4565; 1.4529; EN 10088-1:2014		
4	Hexagon nut	Property class 5 or 8; EN ISO 898-2:2012 zinc plated ≥ 5 μm, ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 μm EN ISO 10684:2004	Property class 50, 70 or 80 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014			
5	fischer internal threaded anchor RG MI	Property class 5.8 ISO 898-1:2013 zinc plated ≥ 5 μm, ISO 4042:1999 A2K	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	Property class 70 EN ISO 3506-1:2009 1.4565; 1.4529; EN 10088-1:2014		
6	Commercial standard screw or anchor / threaded rod for fischer internal threaded anchor RG MI	Property class 5.8 or 8.8; EN ISO 898-1:2013 zinc plated \geq 5 μ m, ISO 4042:1999 A2K A ₅ > 8 % fracture elongation	Property class 70 EN ISO 3506-1:2009 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014) A ₅ > 8 % fracture elongation	EN 10088-1:2014 A ₅ > 8 %		
7	fischer filling disk FFD similar to DIN 6319-G	zinc plated ≥ 5 μm, EN ISO 4042:1999 A2K or hot-dip galvanised ≥ 40 μm EN ISO 10684:2004	1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362; EN 10088-1:2014	· · · · · · · · · · · · · · · · · · ·		
8	Reinforcing bar EN 1992-1-1:2004 and AC:2010, Annex C	Bars and de-coiled rods, class f_{yk} and k according to NDP or $f_{uk} = f_{tk} = k \cdot f_{yk}$		AC:2010		
9	Rebar part: Bars and de-coiled rods class B or C with fyk Figher Threaded part: Property class 70 or 80 FN ISO 3506 1:2009					
		:2014 Corrosion resistance of :2014 Corrosion resistance of				
Prod	her injection system	FIS EM Plus		Annex A 6		

Specifications of intended use (part 1) Table B1.1: Overview use and performance categories Anchorages subject to FIS EM Plus with ... Anchor rod fischer internal Reinforcing bar fischer rebar threaded anchor anchor RG MI FRA KAKAKAKAKAKAKA Hammer drilling with standard drill all sizes Hammer drilling with hollow drill bit (fischer "FHD", Nominal drill bit diameter (do) Heller "Duster 12 mm to 35 mm Expert"; Bosch Speed Clean"; Hilti "TE-CD, TE-YD") Diamond drilling all sizes Tables: Tables: Tables: Tables: uncracked C1.1 C2.1 C3.1 C3.2 concrete Static and quasi C4.1 C4.1 C4.1 C4.1 all sizes all sizes all sizes all sizes static load, in C5.1 C7.1 C9.1 C11.1 cracked C6.1 C8.1 C10.1 C12.1 concrete C13.2 C14.1 C14.2 C13.1 Tables: Tables: M₁₀ ф10 C15.1 C16.1 Seismic C1 to to C16.2 C16.2 performance M30 ф32 C17.1 C17.2 category (only hammer drilling with M12 Tables: standard / hollow M16 C15.1 C2 drill bits) M20 C16.2 M24 C18.1 dry or wet 11 all sizes concrete Use category water filled 12 all sizes (not permitted in combined with service life time 100 years) hole Installation direction D3 (downward and horizontal and upwards (e.g. overhead) installation) Installation $T_{i,min} = -5$ °C to $T_{i,max} = +40$ °C temperature Temperature (max. short term temperature +60 °C; -40 °C to +60 °C max. long term temperature +35 °C) range I In-service temperature Temperature (max. short term temperature +72 °C; -40 °C to +72 °C range II max. long term temperature +50 °C) fischer injection system FIS EM Plus Annex B 1 Intended use Specifications (part 1)

Specifications of intended use (part 2)

Base materials:

 Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- For all other conditions according to EN1993-1-4:2015 corresponding to corrosion resistance classes to Annex A 6 table 6.1.

Design:

- · Anchorages have to be designed by a responsible engineer with experience of concrete anchor design.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed in accordance with:
 EN 1992-4:2018 and EOTA Technical Report TR 055.
 Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
 Fastening in stand-off installation or with a grout layer under seismic action are not covered in this European Technical Assessment (ETA).

Installation:

- Anchor installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- In case of aborted hole: The hole shall be filled with mortar
- · Anchorage depth should be marked and adhered to on installation
- · Overhead installation is allowed

fischer injection system FIS EM Plus	
Intended use Specifications (part 2)	Annex B 2

Table B3.1: Installation parameters for anchor rods													
Anchor rods			Thread	M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Width across flats		SW		13	17	19	22	24	30	32	36	41	46
Nominal drill hole di	ameter	d ₀		10	12	14	16	18	22 24 ¹⁾	25	28	30	35
Drill hole depth		h ₀		$h_0 = h_{\text{ef}}$									
Effective	h _{ef, min}			60	60	70	75	80	90	93	96	108	120
embedment depth		h _{ef, max}	[mm]	160	200	240	280	320	400	440	480	540	600
Diameter of the	pre-positioned installation		[]	9	12	14	16	18	22	24	26	30	33
clearance hole of the fixture	push through installation	df		12	14	16	18	20	26	28	30	33	40
Minimum thickness member	of concrete	h _{min}		h _{ef} + 30 (≥ 100) h _{ef} + 2d ₀									
Maximum torque mo		max T _{fix}	[Nm]	10	20	40	50	60	120	135	150	200	300

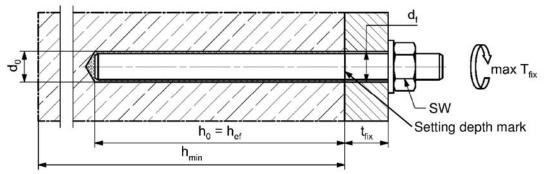
¹⁾ Both drill hole diameters can be used



Marking (on random place) fischer anchor rod:

Property class 8.8, stainless steel, property class 80 and high corrosion resistant steel, property class 80: • Stainless steel A4, property class 50 and high corrosion resistant steel, property class 50: • Alternatively: Colour coding according to DIN 976-1

Installation conditions:



Commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled

- Materials, dimensions and mechanical properties according to Annex A 6, Table A6.1
- Inspection certificate 3.1 according to EN 10204:2004, the documents have to be stored
- Setting depth is marked

Figures not to scale

fischer injection system FIS EM Plus	
Intended use Installation parameters anchor rods	Annex B 3

reinforcing b		T	T		T					
Anchor rods	neter) ф	M8	M10	M12	M14	M16	-	M20	M22	M24
Reinforcing bars (nominal diam	8	10	12	14	16	18	20	22	24	
Minimum edge distance										
Uncracked / cracked concrete	C _{min} [mm	1 40	45	45	45	50	55	55	55	60
Minimum spacing	Smin	according to Annex B5								
Minimum spacing										
Uncracked / cracked concrete	Smin	40	45	55	60	65	85	85	95	105
Minimum edge distance	C _{min} [mr	,			accordi	ng to Aı	nnex B	5		
Required projecting area			ii ii ii ii							
Uncracked concrete	, [100	n 8	13	22	23	24	38,5	38,5	39,5	40
	, 100	J					00,0	00,0	, 00,0	
Cracked concrete	- A _{sp,req} nm	<u> </u>	10	16,5	17,5	18,5	29,5	29,5	30	
Cracked concrete Anchor rods	_ ^\ -	——					-		<u> </u>	30,5
	- A _{sp,req} mm	——		16,5		18,5	-		<u> </u>	
Anchor rods	- A _{sp,req} mm	6,5	10	16,5 M27	17,5	18,5 M30	29,5	29,5	30	30,5
Anchor rods Reinforcing bars (nominal diam	neter) ф	- 25	10	16,5 M27	17,5	18,5 M30	29,5	29,5	30	30,5
Anchor rods Reinforcing bars (nominal diam Minimum edge distance	- A _{sp,req} mm ²	- 25	10 - 26	16,5 M27 - 75	17,5 - 28	18,5 M30 30	29,5 - 32	29,5 - 34	30 - 36	30,5 - 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete	neter) ф	- 25	10 - 26	16,5 M27 - 75	17,5 - 28 80	18,5 M30 30	29,5 - 32	29,5 - 34	30 - 36	30,5 - 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing	neter) ф	- 25	10 - 26	16,5 M27 - 75	17,5 - 28 80	18,5 M30 30	29,5 - 32	29,5 - 34	30 - 36	30,5 - 40
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing	neter) ф	- 25	10 - 26 75	16,5 M27 - 75	17,5 - 28 80 accordi	M30 30 80 ng to Ai	29,5 - 32 120 nnex B5	29,5 - 34 120 5	30 - 36 135	30,5 - 40 175
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete	- Asp,req mm ² neter) φ Cmin Smin [mm	- 25	10 - 26 75	16,5 M27 - 75	17,5 - 28 80 accordi	M30 30 80 ng to Ai	29,5 - 32 120 nnex B5	29,5 - 34 120 5	30 - 36 135	30,5 - 40 175
Anchor rods Reinforcing bars (nominal diam Minimum edge distance Uncracked / cracked concrete Minimum spacing Minimum spacing Uncracked / cracked concrete Minimum edge distance	- Asp,req mm ² neter) φ Cmin Smin [mm	- 25 75 1 120	10 - 26 75	16,5 M27 - 75	17,5 - 28 80 accordi	M30 30 80 ng to Ai	29,5 - 32 120 nnex B5	29,5 - 34 120 5	30 - 36 135	30,5 - 40 175

Splitting failure for minimum edge distance and spacing in dependence of the effective embedment depth h_{ef} .

For the calculation of minimum spacing and minimum edge distance of anchors in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

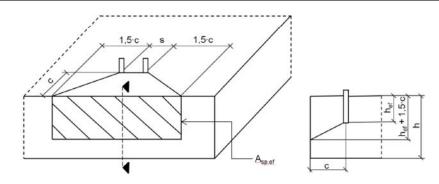
$$A_{sp,req} < A_{sp,t}$$

 $A_{sp,req}$ = required projecting area

 $A_{sp,t} = A_{sp,ef} = effective projecting area (according to Annex B5)$

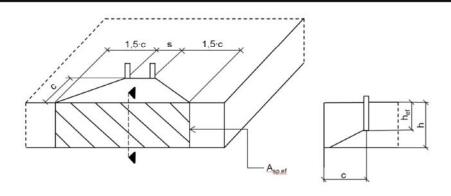
fischer injection system FIS EM Plus	
Intended use Minimum spacing and edge distance for anchor rods and reinforcing bars	Annex B 4

Table B5.1: Effective projecting area $A_{sp,t}$ with concrete member thickness $h > h_{ef} + 1,5 \cdot c$ and $h \ge h_{min}$



Single anchor		$A_{sp,t} = (3 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with c ≥ c _{min}
Group of anchors with	s > 3 · c	$A_{sp,t} = (6 \cdot c) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	WILLI C = Cmin
Group of anchors with	s ≤ 3 · c	$A_{sp,t} = (3 \cdot c + s) \cdot (h_{ef} + 1, 5 \cdot c)$	[mm²]	with $c \ge c_{min}$ and $s \ge s_{min}$

Table B5.2: Effektive projecting area $A_{sp,t}$ with concrete member thickness $h \le h_{ef} + 1,5 \cdot c$ and $h \ge h_{min}$



Single anchor		$A_{sp,t} = 3 \cdot c \cdot existing h$	[mm²]	with c ≥ c _{min}
Group of anchors with	s > 3 · c	$A_{sp,t} = 6 \cdot c \cdot existing h$	[mm²]	WILIT C Z Cmin
Group of anchors with	$s \le 3 \cdot c$	$A_{sp,t} = (3 \cdot c + s) \cdot existing h$	[mm²]	with $c \ge c_{min}$ and $s \ge s_{min}$

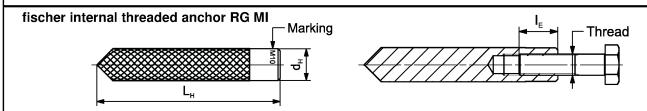
Edge distance and axial spacing shall be rounded up to at least 5 mm

Figures not to scale

fischer injection system FIS EM Plus	
Intended use Minimum thickness of concrete member for anchor rods, minimum spacing and edge distance	Annex B 5

Table B6.1: Installation parameters plus minimum spacing and minimum edge distance for fischer internal threaded anchors RG MI

Internal threaded anchors R	G MI	Thread	M8	M10	M12	M16	M20
Diameter of anchor	$d_{nom} = d_H$		12	16	18	22	28
Nominal drill hole diameter	d₀		14	18	20	24	32
Drill hole depth	h ₀				$h_0 = h_{\text{ef}} = L_{\text{H}}$		
Effective embedment depth (hef = LH)	h _{ef}		90	90	125	160	200
Minimum spacing and minimum edge distance	Smin = Cmin	[mm]	55	65	75	95	125
Diameter of clearance hole in the fixture	df		9	12	14	18	22
Minimum thickness of concrete member	h _{min}		120	125	165	205	260
Maximum screw-in depth	I _{E,max}		18	23	26	35	45
Minimum screw-in depth	l _{E,min}		8	10	12	16	20
Maximum torque moment for attachment of the fixture	max T _{fix}	[Nm]	10	20	40	80	120



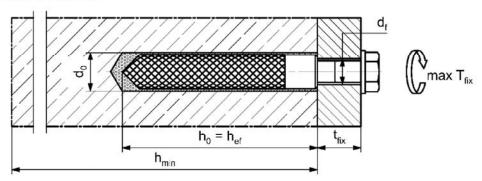
Marking: Anchor size e. g.: M10

Stainless steel → additional A4; e.g.: M10 A4

High corrosion resistant steel → additional C; e.g.: M10 C

Retaining bolt or threaded rods (including nut and washer) must comply with the appropriate material and strength class of Annex A 6, Table A6.1

Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use

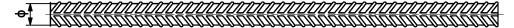
Installation parameters internal threaded anchors RG MI

Annex B 6

Table B7.1: Installation	param	eters f	or rein	forcing	g bars						
Nominal diameter of the bar		ф	8 ¹⁾	10 ¹⁾	12 ¹⁾	14	16	18	20	22	24
Nominal drill hole diameter	d ₀		10 12	12 14	14 16	18	20	25	25	30	30
Drill hole depth	h ₀			•			$h_0 = h_{ef}$	•			
Effective	$h_{\text{ef},\text{min}}$	[mm]	60	60	70	75	80	85	90	94	98
embedment depth	h _{ef,max}	[[[[[[[[[[[[[[[[[[160	200	240	280	320	360	400	440	480
Minimum thickness of concrete member	h _{min}			of + 30 : 100)				h _{ef} + 2	?d₀		
N			0.5					0.4		40	
Nominal diameter of the bar		Φ	25	26	28	30	32	34	36	40	-
Nominal drill hole diameter	d_0		30	35	35	40	40	40	45	55	-
Drill hole depth	h_0						$h_0 = h_{\text{ef}}$				
Effective	h _{ef,min}] [mm]	100	104	112	120	128	136	144	160	-
embedment depth	h _{ef,max}] ['''''']	500	520	560	600	640	680	720	800	-
Minimum thickness of concrete member	h _{min}						h _{ef} + 2d)			

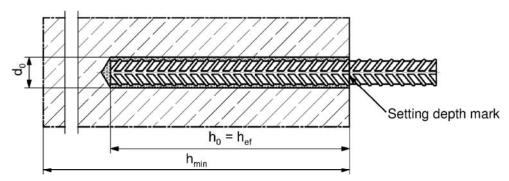
¹⁾ Both drill hole diameters can be used

Reinforcing bar



- The minimum value of related rib area f_{R,min} must fulfil the requirements of EN 1992-1-1:2004+AC:2010
- The rib height must be within the range: $0.05 \cdot \phi \le h_{rib} \le 0.07 \cdot \phi$ (ϕ = Nominal diameter of the bar , h_{rib} = rib height)

Installation conditions:



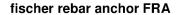
Figures not to scale

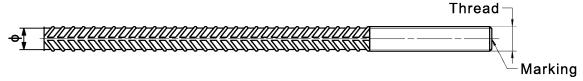
fischer injection system FIS EM Plus	
Intended use Installation parameters reinforcing bars	Annex B 7

Table B8.1:	Installation parameters plus minimum spacing and minimum edge distance
	for fischer rebar anchor FRA

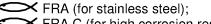
Rebar anchor FRA		Thread	M1:	2 ¹⁾	M16	M20	M24
Nominal diameter of the bar	ф		12	2	16	20	25
Width across flats	SW		19)	24	30	36
Nominal drill hole diameter	d₀		14	16	20	25	30
Drill hole depth	h ₀				h _{ef}	+ le	
Effective embedment depth	h _{ef,min}		70)	80	90	96
Linective embedinent deptin	$h_{\text{ef},\text{max}}$		14	0	220	300	380
Distance concrete surface to welded joint	l _e	[]			10	00	
Minimum spacing and minimum edge distance	Smin = Cmin	[mm]	55	5	65	85	105
Diameter of pre-positione anchorage	d ≤ d _f		14	1	18	22	26
clearance hole in the fixture push through anchorage	l ≤ d _f		18	3	22	26	32
Minimum thickness of concrete member	h_{min}		h ₀ + (≥ 1		h ₀ + 2d ₀		
Maximum torque moment for attachment of the fixture	max T _{fix}	[Nm]	40)	60	120	150

¹⁾ Both drill hole diameters can be used



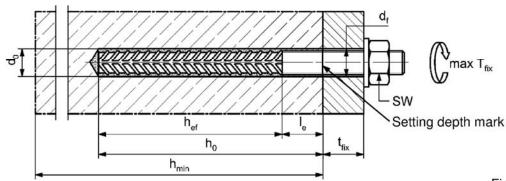


Marking frontal e. g:



FRA C (for high corrosion resistant steel)

Installation conditions:



Figures not to scale

fischer injection system FIS EM Plus

Intended use

Installation parameters rebar anchor FRA

Annex B 8

Table B9.1: Parameters of the cleaning brush BS / BSB (steel brush)

The size of the cleaning brush refers to the drill hole diameter

Nominal drill hole diameter	d₀	[mm]	10	12	14	16	18	20	24	25	28	30	32	35	40	45	55
Steel brush diameter	dь	[mm]	11	14	16	2	0	25	26	27	30		40		42	47	58



Table B9.2 Maximum processing time of the mortar and minimum curing time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]	Maximum processing time t _{work}	Minimum curing time t _{cure}
-5 to -1	240 min	200 h
±0 to +4	150 min	90 h
+5 to +9	120 min	40 h
+10 to +19	30 min	18 h
+20 to +29	14 min	10 h
+30 to +40	7 min	5 h

¹⁾ In wet concrete or water filled holes the curing times must be doubled

fischer injection system FIS EM Plus	
Intended use	Annex B 9
Cleaning brush (steel brush)	
Processing time and curing time	

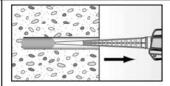
Installation instructions part 1 Drilling and cleaning the hole (hammer drilling with standard drill bit) Drill the hole. Nominal drill hole diameter do and drill hole depth ho 1 see tables B3.1, B6.1, B7.1, B8.1 Cleaning the drill hole: 2 Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) Brush the drill hole twice. For drill hole diameter ≥ 30 mm use a power drill. 3 For deep holes use an extension. Corresponding brushes see table B9.1 Cleaning the drill hole: 4 Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) Go to step 6 Drilling and cleaning the hole (hammer drilling with hollow drill bit) Check a suitable hollow drill (see table B1.1) 1 for correct operation of the dust extraction Use a suitable dust extraction system, e. g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data 2 Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter do and drill hole depth ho see tables B3.1, B6.1, B7.1, B8.1 Go to step 6 fischer injection system FIS EM Plus Annex B 10 Intended use Installation instructions part 1

Installation instructions part 2 Drilling and cleaning the hole (wet drilling with diamond drill bit) Drill the hole. Drill hole diameter do and Break the drill core 1 nominal drill hole depth ho and remove it see tables B3.1, B6.1, B7.1, B8.1 2 Flush the drill hole with clean water until it flows clear 3 Blow out the drill hole twice, using oil-free compressed air (p > 6 bar) Brush the drill hole twice using a power drill. 4 Corresponding brushes see table B9.1 5 Blow out the drill hole twice, using oil-free compressed air (p > 6 bar) Preparing the cartridge Remove the sealing cap 6 Screw on the static mixer (the spiral in the static mixer must be clearly visible) 7 Place the cartridge into the dispenser Extrude approximately 10 cm of material out until 8 the resin is evenly grey in colour. Do not use mortar that is not uniformly grey fischer injection system FIS EM Plus Annex B 11 Intended use Installation instructions part 2

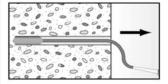
Installation instructions part 3

Injection of the mortar

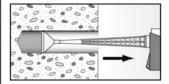
9



Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles



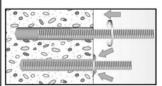
For drill hole depth ≥ 150 mm use an extension tube

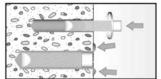


For overhead installation, deep holes ($h_0 > 250$ mm) or drill hole diameter ($d_0 \ge 40$ mm) use an injection-adapter

Installation of anchor rods or fischer internal threaded anchors RG MI

10



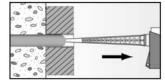


Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so.

After inserting the anchor element, excess mortar must be emerged around the anchor element.



For overhead installations support the anchor rod with wedges (e. g. fischer centering wedges) or fischer overhead clips.



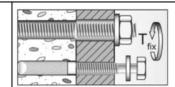
For push through installation fill the annular gap with mortar

11



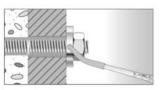
Wait for the specified curing time t_{cure} see table B9.2

12



Mounting the fixture max T_{fix} see tables B3.1 and B6.1

Option



After the minimum curing time is reached, the gap between anchor and fixture (annular clearance) may be filled with mortar via the fischer filling disc FFD. Compressive strength ≥ 50 N/mm² (e.g. fischer injection mortars FIS HB, FIS SB, FIS V, FIS EM Plus)

ATTENTION: Using fischer filling disk FFD reduces t_{fix} (usable length of the anchor)

fischer injection system FIS EM Plus

Intended use

Installation instructions part 3

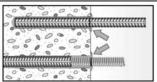
Annex B 12

Installation instructions part 4

Installation reinforcing bars and fischer rebar anchor FRA

Only use clean and oil-free reinforcing bars or fischer FRA. Mark the setting depth. Turn while using force to push the reinforcement bar or the fischer FRA into the filled hole up to the setting depth mark

10



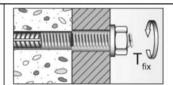
When the setting depth mark is reached, excess mortar must be emerged from the mouth of the drill hole.

11



Wait for the specified curing time t_{cure} see **table B9.2**

12



Mounting the fixture max T_{fix} see **table B8.1**

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Intended use

Installation instructions part 4

Annex B 13

Table C1.1: Essential characteristics ³⁾ for the steel bearing capacity under tensile / shear load of fischer anchor rods and standard threaded rods														
Anch	or rod / standard	threaded rod	l		М8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Beari	ng capacity unde	r tensile load	l, stee	el fail	ure									
rstic N _{RK,s}	Steel zinc plated		5.8	1		29(27)	43	58	79	123	152	177	230	281
erst e N		Droporti	8.8		29(27)	47(43)	68	92	126	196	243	282	368	449
ract	Stainless steel A4		50	[kN]	19	29	43	58	79	123	152	177	230	281
Characterstic esistance N _{Rk}	and high corrosion resistant steel C	1	70		26	41	59	81	110	172	212	247	322	393
			80		30	47	68	92	126	196	243	282	368	449
Partia	al factors 1)				I				1.5					
ģ	Steel zinc plated		5.8 8.8						1,5					
Partial factor		Property	50	[-]					1,5 2,8					
rtia `ĭ	Stainless steel A4 and high corrosion	class	70	[-]										
Pa	resistant steel C	'	80		1,50 ²⁾ / 1,87 1,60									
Beari	ng capacity unde	r shear load.		failu	re				1,0					
	ut lever arm	,												
rstic V ⁰ RK,s	Otaal sina platad		5.8		9(8)	15(13)	21	29	39	61	76	89	115	141
Characterstic	Steel zinc plated		8.8]	15(13)	23(21)	34	46	63	98	122	141	184	225
Stainless steel A4 and high corrosion	Property class	50	[kN]	9	15	21	29	39	61	76	89	115	141	
har Sista	क्षे and high corrosion		70		13	20	30	40	55	86	107	124	161	197
CC	resistant steel C		80		15	23	34	46	63	98	122	141	184	225
	ity factor		k ₇	[-]					1,0)				
with I	ever arm			I	10(10)	07/00)	05	101	100	204	4.47	500	222	4400
~ %	Steel zinc plated		5.8	1		37(33)	 	104	166	324	447	560	833	1123
act.		Property	8.8		<u> </u>	60(53)	-	167	266	519	716	896	1333	1797
Charact. stance M ⁰ Rk	Stainless steel A4	class		[Nm]		37	65	104	166	324	447	560	833	1123
esis	and high corrosion resistant steel C	1	70 80		26 30	52	92 105	146 167	232 266	454 519	626 716	784 896	1167 1333	1573 1797
	al factors ¹⁾		00		30	60	105	167	200	519	710	090	1333	1/9/
			5.8						1,2	5				
Partial factor	Steel zinc plated		8.8	1					1,2					
ial fa Yms,v	Stainless steel A4	Property	50	[-]					2,3					
artis	and high corrosion	class	70						1,25 ²⁾ /	1,56				
-	resistant steel C		80			1,33								
²⁾ O ro ³⁾ V	n absence of other landy admissible for lods) alues in brackets a alues in brackets a	nigh corrosior re valid for ur	resis idersi	stant s zed th	readed	rods w	ith sm	aller st		·				ed
Perf	her injection sys											Anne	ex C	1

Essential characteristics for the steel bearing capacity of fischer anchor rods and

standard threaded rods

						el bearing inchors R0			o, onoa			
fischer internal	threade	ed anchors	RG MI		М8	M10	M12	M16	M20			
Bearing capacit	y unde	r tensile loa	ad, stee	el failu	ıre							
		Property	5.8		19	29	43	79	123			
Charact. resistance with	N _{Rk,s}	class	8.8	[kN]	29	47	68	108	179			
screw	INHK,S	Property	_A4	[KIN]	26	41	59	110	172			
		class 70	С		26	41	59	110	172			
Partial factors ¹⁾												
		Property	5.8				1,50					
Partial factors	γMs,N	class	8.8	[-]	1,50							
r artial ractors	y IVIS,IN	Property	_A4				1,87					
		class 70	С				1,87					
Bearing capacity	<u> </u>	r shear load	d, steel	failu	re							
Without lever ar	m											
	Property	5.8		9,2	14,5	21,1	39,2	62,0				
Charact. resistance with	$V^0_{Rk,s}$	class	8.8	[kN]	14,6	23,2	33,7	54,0	90,0			
screw	V nr,s	Property	_A4	[[[,,]	12,8	20,3	29,5	54,8	86,0			
		class 70	С		12,8	20,3	29,5	54,8	86,0			
Ductility factor			k ₇	[-]			1,0					
With lever arm						1	Г	1	Г			
Charact		Property	5.8		20	39	68	173	337			
Charact. resistance with	$M^0_{Rk,s}$	class	8.8	[Nm]	30	60	105	266	519			
screw	IVI NK,S	Property	_A4	[[, ,,,,]	26	52	92	232	454			
		class 70	С		26	52	92	232	454			
Partial factors ¹⁾												
		Property	5.8				1,25					
Partial factors	γMs,V	class	8.8	[-]			1,25					
r artial radiolo	[IVIS, V	Property	_A4				1,56					
		class 70	С				1,56					

fischer injection system FIS EM Plus	T
Performance Essential characteristics for the steel bearing capacity of fischer internal threaded anchor RG MI	Annex C 2

Nominal diameter of the bar Bearing capacity under tensile load, Characterstic resistance N _R Bearing capacity under shear load, s Without lever arm Characterstic resistance V ⁰ _F Ductility factor k With lever arm Characteristic resistance M ⁰ _F	k,s [kN teel fail kk,s [kN 7 [-]	ilur ure	re		2 24 25 As · fuk1) 5 · As · fuk 0,8		30 3	2 34 36				
Characterstic resistance Rearing capacity under shear load, s Without lever arm Characterstic resistance Ductility factor With lever arm Characteristic resistance More	k,s [kN teel fail kk,s [kN 7 [-]	ure			o · A₅ · f _{uk}	,1)						
Bearing capacity under shear load, s Without lever arm Characterstic resistance Ductility factor With lever arm Characteristic resistance More	teel fail	ure	9		o · A₅ · f _{uk}	(1)						
Without lever arm Characterstic resistance V° _F Ductility factor k· With lever arm Characteristic resistance M° _F	7 [-]]	9	0,		(1)						
Characterstic resistance V ⁰ F Ductility factor k: With lever arm Characteristic resistance M ⁰ F	7 [-]	-		0,5		(1)						
Ductility factor k: With lever arm Characteristic resistance More	7 [-]	-		0,8		(1)						
With lever arm Characteristic resistance Mor					0,8							
Characteristic resistance Mor							0,8					
	. [FN 1											
1) fuk or fyk respectively must be taken	Characteristic resistance Mo _{Rk,s} [Nm] 1,2 · W _{el} · f _{uk1)}											
Table C3.2: Essential character for the control of	teristic	s f	for the steel			under	tensile	e / shear				
fischer rebar anchor FRA			M12	M16		M20		M24				
Bearing capacity under tensile load,	steel fai	ilur	re									
Characterstic resistance N _R	_{k,s} [kN	I] [63	111		173		270				

Indenier resear america i i iii			=		0			
Bearing capacity under tens	ile load, ste	el failu	ire					
Characterstic resistance	$N_{Rk,s}$	[kN]	63	111	173	270		
Partial factor ¹⁾				-				
Partial factor	γMs,N	[-]		1	,4			
Bearing capacity under shea	ar load, stee	l failur	·e					
Without lever arm								
Characterstic resistance	$V^0_{Rk,s}$	[kN]	30	55	86	124		
Ductility factor	k ₇	[-]	1,0					
With lever arm								
Characteristic resistance	M^0 Rk,s	[Nm]	92	233	454	785		
Partial factor ¹⁾		•						
Partial factor	γMs,V	[-]		1,	56			
		•						

¹⁾ In absence of other national regulations

fischer injection system FIS EM Plus	
Performance Essential characteristics for the steel bearing capacity of reinforcing bars and fischer rebar anchors FRA	Annex C 3

Size Fensile load												ΑI	l s	zes							
														203							
Jncracked concrete		k _{ucr,N}	Ī	1									11	.0							
Oracked concrete		k _{cr,N}	[-]										7,								_
Factors for the cor	npressive strer		concr	ete	>	C20	0/25	;					• ,	<u>'</u>							
	C25/30	9											1,0)2							
	C30/37												1,0								
ncreasing ——	C35/45												1,0								
actor for τ _{Rk}	C40/50	Ψ_{c}	[-]										1,0								_
	C45/55												1,0								
	C50/60												1,0								
Splitting failure				l																	_
	h / h _{ef} ≥ 2,0											1	,0	h _{ef}							_
Edge distance 2,0	$0 > h / h_{ef} > 1,3$	C _{cr.sp}	l <u> </u>											- 1,8 ł	า						
	h / h _{ef} ≤ 1,3	, - II-	[mm]											h _{ef}							_
Spacing		S _{cr,sp}										2	2 Co	r,sp							_
Concrete cone fail	ure																				_
Edge distance		Ccr,N	[1	,5	h _{ef}							
Spacing		Scr,N	[mm]									2	2 c	cr,N							_
Shear load																					
nstallation factor		γinst	[-]										1,	0							_
Concrete pry-out fa	ailure																				_
actor for pry-out fa		k ₈	[-]										2,	0							_
Concrete edge fail																					
The value of h_{ef} (= l_f)			· , ,					С	Condi	itior	ns a	ccor	dir	ng to	1992	2-4:	201	8:			
under shear load í			[-]				(cha	apte	r 7.2	2.2.	5; S	ect	ion 6	; for	mul	ar 7	.43			
Calculation diamet	ers																				
Size				М	8	M	110	Ν	<i>l</i> 112	M.	14	M1	6	M20	М	22	M2	24	M27	M	13
ischer anchor rods standard threaded r		d_{nom}		8	3	-	10		12	1.	4	16	,	20	2	22	24	4	27	(30
ischer			[mm]		_	+		\vdash					\dashv		\vdash			\dashv		+	
nternal threaded an	chors RG MI	d_{nom}		12	2	1	6	ĺ	18	-	•	22	:	28		-	-	ĺ	-		-
ischer rebar anchor	FRA	d _{nom}		-			-		12	-		16	,	20		-	25	5	-		-
Size (nominal diame	eter of the bar)		ф	8	1	0 1	2 1	4	16	18	20	22	24	1 25	26	28	30	32	34	36	4
Reinforcing bar		dnom	[mm]	8	1	A 4	2 1	4	16	18	20	22	2/	1 25	26	28	20	32	34	36	

Table C5.1:	Essential standard uncrack	l threa	ded rod	s in h	amme	er or o	liamoı	nd dril	led h	oles;	nor ro	o ds ar	nd
Anchor rod / s	tandard thread	ded rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pul	lout and conci	ete con	e failure										
Calculation dia		d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked co	ncrete												
Characteristic	bond resistan	ce in un	cracked (concre	ete C20)/25							
Hammer-drilling	g with standard	drill bit c	r hollow d	lrill bit (dry or	wet co	ncrete)						
	35 °C / 60 °C			18	18	18	17	17	16	15	15	15	14
perature —— range II:	50 °C / 72 °C	τRk,ucr	[N/mm ²]	18	17	17	16	16	15	14	14	14	13
	g with standard	drill bit c	r hollow d	lrill bit (water t	illed h	ulle)						
_	35 °C / 60 °C			16	16	15	13	13	11	11	10	10	9
perature	50 °C / 72 °C	τRk,ucr	[N/mm ²]	15	14	14	13	12	11	10	10	9	9
range							13	12	11	10	10	9	9
	g (dry or wet co	ncrete a	s well as v	1			10	10	40	10	10		
perature —	35 °C / 60 °C	τ _{Rk,ucr}	[N/mm ²]	16	15	13	12	12	10	10	10	9	9
range II:	50 °C / 72 °C			15	14	12	11	11	10	9	9	8	8
Installation fac			1										
Dry or wet cond		γinst	[-]						,0				
Water filled hol	e	711150	.,					1,	,4				
Cracked conc	rete												
Characteristic bond resistance in cracked concrete C20/25													
	g with standard	<u>drill bit c</u>	<u>r hollow d</u>	rill bit (dry or	wet co	ncrete)	-		I	ı	I	
Tem- I:	35 °C / 60 °C	·	 [N/mm²]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
range II:	50 °C / 72 °C	TRk,cr	[14/11111-]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
<u>Diamond - drilli</u>	ng (dry or wet o	oncrete)		I						I	I	I	
Tem- I:	35 °C / 60 °C			7	7	7	7	6	6	7	7	7	7
perature II.	50 °C / 72 °C	τ _{Rk,cr}	[N/mm ²]	7	7	7	7	6	6	7	7	7	7
Tarigo	g with standard	drill bit o	r hallaw d					_	_				
	35 °C / 60 °C	arm bit c	11011044 0	6	7,5	7,5	7	6	6	6	6	6	6
perature	50 °C / 72 °C	τ _{Rk,cr}	[N/mm ²]	6	7	7	7	6	6	6	6	6	6
range				0	′			U	0	0	0	O .	0
Installation fac			Ι						^				
Dry or wet conc Water filled hole		γinst	[-]			1.2		- 1,	,0		1 /		
water filled flote						1,2					1,4		
Performance Essential cha	etion system racteristics of te	ensile res	sistance fo	or fisch	er anch	nor rod	and st	andard	1		Ann	ex C	5

Table C6.1: Essential standard cracked	thread	ded rod	s in h	amme	er or o	liamo	nd dri					_
Anchor rod / standard thread	led rod		M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Combined pullout and concr	ete con	failure										
Calculation diameter	d	[mm]	8	10	12	14	16	20	22	24	27	30
Uncracked concrete											•	
Characteristic bond resistan	ce in un	cracked (concre	te C20)/25							
Hammer-drilling with standard	drill bit o	r hollow d	rill bit (dry or	wet co	ncrete)						
Tem- I: 35 °C / 60 °C			18	18	18	17	17	16	15	15	15	14
perature II: 50 °C / 72 °C	τ _{Rk,ucr}	[N/mm²]	18	17	17	16	16	15	14	14	14	13
range II: 50 °C / 72 °C Diamond-drilling (dry or wet co	ncroto)		10	.,	.,		10	10			l ''	
Tem- 1: 35 °C / 60 °C	<u>Horetej</u>		16	15	13	12	12	10	10	10	9	9
perature ————	τ _{Rk,ucr}	[N/mm²]										
range II: 50 °C / 72 °C			15	14	12	11	11	10	9	9	8	8
Installation factors												
Dry or wet concrete	γinst	[-]					1	,0				
Service I: 35 °C / 60 °C		.,	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
100 years II: 50 °C / 72 °C	α ₁₀₀ years	[-]	0,55	0,60	0,60	0,65	0,65	0,65	0,65	0,65	0,65	0,6
Cracked concrete												
Characteristic bond resistan	ce in cra	cked co	ncrete	C20/2	5							
Hammer-drilling with standard	<u>drill bit o</u>	r hollow d	rill bit (dry or	wet co	ncrete)	<u> </u>					
Tem- I: 35 °C / 60 °C		[N] /ma ma 21	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
perature II: 50 °C / 72 °C	τ _{Rk,cr}	[N/mm²]	7,5	7,5	9	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Diamond - drilling (dry or wet c	oncrete)						ı			1		
Tem- I: 35 °C / 60 °C			7	7	7	7	6	6	7	7	7	7
perature II: 50 °C / 72 °C	TRk,cr	[N/mm²]	7	7	7	7	6	6	7	7	7	7
Installation factors												
Dry or wet concrete	γinst	[-]					1	,0				
Service I: 35 °C / 60 °C	fillst	L J	0,60	0,85	0,80	0,65		1	0,65	0,65	0,65	0.65
life time	α _{100 years}	[-]					0,65	0,65	-	-	-	0,65
100 years II: 50 °C / 72 °C			0,60	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65
1) Calculation of characteri $\tau_{Rk,100~years,ucr} = \alpha_{100~years} \cdot \tau_{Rk,100~years} \cdot $	Rk,ucr						·	·				
$ au_{ ext{Rk,100 years,cr}} = lpha_{ ext{100 years}} \cdot au_{ ext{R}}$	k,cr											
fischer injection system I	FIS EM	Plus										
Performance Essential characteristics of te			r fisch	er anch	nor rod	and st	andard	<u> </u>		Ann	ex C	6

threaded rods; service life time 100 years

Combined pullout and concrete cone failure Calculation diameter d [mm] 12 16 18 22 2	Table C7.1:	anchors	RG MI	in hamr		ond drilled		r internal th racked or o	
Calculation diameter d [mm] 12 16 18 22 2 2	Internal threade	d anchor RG	i MI		М8	M10	M12	M16	M20
Characteristic bond resistance in uncracked concrete C20/25	Combined pullo	ut and conc	rete con	e failure					
Characteristic bond resistance in uncracked concrete C20/25 Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) Temperature 1: 35 °C / 60 °C TRIK, uor 14	Calculation diam	eter	d	[mm]	12	16	18	22	28
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete) Temperature I: 35 °C / 60 °C Telk,uor [N/mm²] 15 14 14 13 13 12 1 Hammer-drilling with standard drill bit or hollow drill bit (water filled hole) Temperature I: 35 °C / 60 °C Telk,uor [N/mm²] 14 12 12 11 10 1 Diamond-drilling (dry or wet concrete as well as water filled hole) Temperature I: 35 °C / 60 °C Telk,uor Telk,	Uncracked cond	crete							
Temperature I: 35 °C / 60 °C Telk,ucr [N/mm²] 15									
Temporature III S0 °C / 72 °C TRIK, ucr TRIK	-	with standard	drill bit c	r hollow c	rill bit (dry or	wet concrete)	_	ı	1
Transpance II: 50 °C / 72 °C Transpance II: 50 °C / 72 °C Transpance II: 35 °C / 60 °C Transpance II: 50 °C / 72 °C Transpance II: 10 9 88 10 10 10 10 10 10 10	1. 00	5 °C / 60 °C		[N1/mm2]	15	14	14	13	12
Hammer-drilling with standard drill bit or hollow drill bit (water filled hole) Temperature I: 35 °C / 60 °C TRIK, ucr [N/mm²] 14	11. 57) °C / 72 °C	TRk,ucr	[IN/IIIII-] 	14	13	13	12	11
Tem- I: 35 °C / 60 °C Telk, ucr Te		with standard	drill bit c	r hollow c	rill bit (water	filled hole)		1	ı
Perature range II: 50 °C / 72 °C TRIK, UCF T	_				<u>, </u>		12	11	10
Diamond-drilling (dry or wet concrete as well as water filled hole) Tem-	perature ———		τ _{Rk,ucr}	[N/mm ²]					9
Temperature I: 35 °C / 60 °C Telk,ucr [N/mm²] 13 12 11 10 9 8	ango		noroto o	c well ac			11	10	
Tem-perature range I: 35 °C / 60 °C TRk, or range I: 35 °C / 60 °C TRk, or range I: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRk, or range II: 50 °C / 72 °C TRK, or range II: 50 °C / 72 °	_		nicrete a	S Well as			11	10	9
Installation factors Toy or wet concrete Toy or wet concret	perature ——		τ _{Rk,ucr}	[N/mm²]					
Tem- 1: 35 °C / 60 °C Tem- 2: 35 °C / 60 °C Tem- 1: 35 °C	ange II: 50) °C / 72 °C			12	11	10	9	8
Tem- range I: 35 °C / 60 °C Tem- range I: 50 °C / 72 °C Tem- range I: 35 °C / 60 °C Tem- range I: 50 °C / 72 °C Tem- range I: 35 °C / 60 °C Tem- range I: 50 °C / 72 °C Tem									
Water filled note 1,4 Cracked concrete Characteristic bond resistance in cracked concrete C20/25 Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete) Tem-perature range I: 35 °C / 60 °C TRK,cr [N/mm²] 7 6 6 7 7 Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole) Tem-perature range I: 35 °C / 60 °C TRk,cr [N/mm²] 7 6,5 6		ete	Vinst	[-]			-		
Characteristic bond resistance in cracked concrete C20/25 Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete) Tem- perature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr IIII bit or hollow drill bit and diamond-drilling (water filled hole) Tem- perature range II: 35 °C / 60 °C Perature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range II: 35 °C / 60 °C III: 50 °C / 72 °C TRIK, cr III bit and diamond-drilling (water filled hole) Tomperature range			,	.,			1,4		
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry or wet concrete) Temperature range I: 35 °C / 60 °C TRK, cr [N/mm²] 7 6 6 7 7 7 7 7 7 7									
Tem- perature range I: 35 °C / 60 °C TRK,cr [N/mm²] 7 6 6 7 7 Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (water filled hole) Tem- perature range I: 35 °C / 60 °C TRK,cr [N/mm²] 7 6,5 6 6 6 II: 50 °C / 72 °C TRK,cr [N/mm²] 7 6 6 6 Installation factors Dry or wet concrete 1,0									
Tem- I: 50 °C / 72 °C TRk,cr [N/mm²] 7 6 6 7 7 7 7 7 7 7	_		drill bit c	<u>r hollow c</u> T					I
Trange II: 50 °C / 72 °C 7 6 6 7 7 6 6 7 7 6 6	1. 00	5 °C / 60 °C	TRk or	 [N/mm²]	7	6	6	7	7
Tem- 1: 35 °C / 60 °C τ _{Rk,cr} [N/mm²] 7 6,5 6 6 6 6 6 6 6 6 6		°C / 72 °C	VI II,CI	[]	7	6	6	7	7
perature II: 50 °C / 72 °C TRk,cr [N/mm²] 7 6 6 6 6 6 6 6 6 6	Hammer-drilling	with standard	drill bit c	r hollow c	Irill bit and dia	mond-drilling	(water filled	hole)	
range II: 50 °C / 72 °C		5 °C / 60 °C			7	6,5	6	6	6
Installation factors Dry or wet concrete 1,0) °C / 72 °C	τRk,cr	[N/mm²]	7	6	6	6	6
Dry or wet concrete 1,0	ange			<u> </u>					
Vinet -							1.0		
			γinst	[-]		1,2	,	1	,4
				l		<u> </u>			

fischer injection system FIS EM Plus	
Performance Essential characteristics of tensile resistance for fischer internal threaded anchors RG MI; service life time 50 years	Annex C 7

Table C8.1: Essential characteristics of tensile resistance for fischer internal threaded anchors RG MI in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 100 years

Combined pullout and concrete cone failure	M16	M20
	•	
Calculation diameter d [mm] 12 16 1	18 22	28
Uncracked concrete		
Characteristic bond resistance in uncracked concrete C20/25		
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)		
	14 13	12
perature range II: 50 °C / 72 °C τ _{Rk,ucr} [N/mm²] 14 13 1	13 12	11
Diamond-drilling (dry or wet concrete)		
	11 10	9
perature range II: 50 °C / 72 °C τ _{Rk,ucr} [N/mm²] 12 11 1	10 9	8
Installation factors	·	
Dry or wet concrete γ_{inst} [-]	,0	
Service I: 35 °C / 60 °C 0,75 0,75 0,	,75 0,75	0,75
life time 100 years II: 50 °C / 72 °C 0,55 0,60 0,	,60 0,65	0,65
Cracked concrete	•	
Characteristic bond resistance in cracked concrete C20/25		
Hammer-drilling with standard drill bit or hollow drill bit and diamond-drilling (dry o	or wet concrete)	
	6 7	7
perature $\frac{1}{\text{II: }50 ^{\circ}\text{C} / 72 ^{\circ}\text{C}} = \frac{\tau_{\text{Rk,cr}}}{ N/\text{mm}^2 } = \frac{7}{7} = \frac{6}{6}$	6 7	7
Installation factors		
Dry or wet concrete γ_{inst} [-]	,0	
	,80 0,65	0,65
life time	,80 0,65	0,65

$^{1)}$ Calculation of characteristic bond resistance in uncracked concrete $\tau_{\text{Rk},100\,\text{years},\text{ucr}}$:

 $\tau_{\text{Rk,100 years,ucr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,ucr}}$

$^{2)}$ Calculation of characteristic bond resistance in cracked concrete $\tau_{\text{Rk},100\;\text{years,cr}}$:

 $\tau_{\text{Rk,100 years,cr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,cr}}$

fischer injection system FIS EM Plus	
Performance Essential characteristics of tensile resistance for fischer internal threaded anchors RG MI; service life time 100 years	Annex C 8

Table C9.1:	Essential hammer of service l	or diam	ond dril	led											_					
Nominal diamete	r of the bar		ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combined pullou	it and concr	ete con	e failure	_																
Calculation diame	ter	d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracked concr	ete			_																
Characteristic bo	nd resistan	ce in un	cracked	con	cret	e C	20/2	:5												
Hammer-drilling w	ith standard	drill bit o	r hollow c	Irill b	oit (c	lry c	r we	et cc	ncr	ete)										
	°C / 60 °C		[N 1 / 27	16	15	15	14	14	13	13	13	12	12	12	12	12	12	11	11	11
perature II: 50	°C / 72 °C	τ _{Rk,ucr}	[N/mm²]	15	14	14	13	13	12	12	12	12	11	11	11	11	11	11	10	10
Hammer-drilling w	ith standard	drill bit o	r hollow c	rill b	oit (v	vate	r fill	ed h	ole)					l	l					
Tem- I: 35	°C / 60 °C			16	16	14	13	12	12	11	11	10	10	10	10	9	9	9	8	8
perature II: 50	°C / 72 °C	τ _{Rk,ucr}	[N/mm²]	15	14	13	12	12	11	11	10	10	9	9	9	9	8	8	8	8
range II: 50 Diamond-drilling (d		ncrete a	l s well as v						• •		. 0									
	°C / 60 °C	noroto a	Vivoli do		15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
perature	°C / 72 °C	τ _{Rk,ucr}	[N/mm²]		14	12	11	11	10	10	9	9	9	8	8	8	8	7	7	7
Installation facto				13	14	12	' '	11	10	10	Э	9	9	0	0	0	0	/	/	
Dry or wet concret			<u> </u>									1,0								
Water filled hole		γinst	[-]									1,4								
Cracked concrete	<u> </u>											1,4								
Characteristic bond resistance in cracked concrete C20/25																				
Hammer-drilling with standard drill bit or hollow drill bit (dry or wet concrete)																				
-	°C / 60 °C			7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
perature	°C / 72 °C	τ _{Rk,cr}	[N/mm ²]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
range		\		'	′	0	0	٥	0		0	0	0	0	0	0	0	0	0	
Diamond-drilling (d	°C / 60 °C	<u>ncrete)</u>		7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
Iperature ———		τ _{Rk,cr}	[N/mm²]																	_
range	°C / 72 °C			7	7			6	6	6	7	7	7	7		7	5	5	5	5
Hammer-drilling w		<u>drill bit o</u>	<u>r hollow c</u>									er fi	lled	hole	Ē					
Tem- I: 35 perature	°C / 60 °C	τRk,cr	 [N/mm²]	6	7,5	6,5	6,5	6,5	6	6	6	6	6	6	6	6	5	5	5	5
range II: 50	°C / 72 °C	CHK,CI	[. •/	6	6,5	6,5	6	6	6	6	6	6	6	6	6	6	5	5	5	5
Installation factor	rs																			
Dry or wet concret	te	Vinot	[-]									1,0								
Water filled hole		γinst	"			1	,2								1,4					
fischer injectio	on system	FIS EM	l Plus																	
Performance Essential charac service life time s		nsile res	istance fo	or rei	info	rcing	g ba	rs;								An	ne	x C	9	

Table C10.1: Essential characteristics of tensile resistance for reinforcing bars in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 100 years																				
Nominal diameter	of the bar		ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Combined pullout	t and conc	rete con	e failure	_																
Calculation diamet	er	d	[mm]	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
Uncracked concre	ete																			
Characteristic bo	nd resistar	nce in un	cracked	con	cret	e C	20/2	25												
Hammer-drilling wi	th standard	l drill bit o	r hollow c	irill k	oit (c	dry c	r we	et co	ncre	ete)										
	C / 60 °C			16	15	15	14	14	13	13	13	12	12	12	12	12	12	11	11	11
perature II: 50 °	C / 72 °C	TRk,ucr	[N/mm ²]	15	14	14	13	13	12	12	12	12	11	11	11	11	11	11	10	10
Diamond-drilling (d	lry or wet c	oncrete)								l				<u> </u>						
	C / 60 °C			16	15	13	12	12	11	10	10	10	9	9	9	9	8	8	8	7
perature	C / 72 °C	- τ _{Rk,ucr}	[N/mm ²]	15							9	9	9	8	8	8	8	7	7	7
range II: 50 ° Installation factor				10	17	12		' '	10	10		<u> </u>			0		0	,	'	,
Dry or wet concrete		γinst	[-]									1,0								
		Tillet		75	22	2,2	75	72	75	75	75		75	2	22	2	75	75	75	22
Service I: 35 °	C / 60 °C	-α _{100 years}	[-]	O,	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
100 years II: 50 °	C / 72 °C	G 100 years	"	0,55	0,60	09'0	0,65	0,65	0,65	0,65	0,65	0,65	0,65	3,65	0,65	9,65	0,65),65	0,65	0,65
Cracked concrete																				
Characteristic bo		nce in cra	acked co	ncre	ete (C20/	25													
Hammer-drilling wi								et co	ncre	ete)										
-	C / 60 °C			7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
perature II: 50°	C / 72 °C	- τRk,cr	[N/mm²]	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Diamond-drilling (d		oncrete)					_	_									_			
	C / 60 °C	<u> </u>		7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
perature 50°	C / 72 °C	- τ _{Rk,cr}	[N/mm ²]	7	7	7	7	6	6	6	7	7	7	7	7	7	5	5	5	5
range				_ ′ _	,	,	′	U	U		_ ′	′	_′_	_ ′			J	J	J	J
Installation factor Dry or wet concrete			r 1									1.0								
,		γinst	[-]	0	2	0	2	2	2	2	2	1,0 ഹ	2	2	2	2	2	2	2	2
	C / 60 °C	~~~	r 1	0,60	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65
life time ————————————————————————————————————	C / 72 °C	- α 100 years	[- <u>]</u>	0,60	0,85	0,80	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65
1) Calculation of TRk,100 years,ucr = 2) Calculation of TRk,100 years,cr = 0 fischer injectio Performance	α _{100 years} · 1 f character α _{100 years} · τ	CRK,ucr r istic bor RK,cr	nd resista										•			Δn	ney		10	

Table C11.1: Essential characteristics of tensile resistance for fischer rebar anchors FRA in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 50 years

	service i	ite tim	e 50 yea	irs			
fischer re	ebar anchor FRA			M12	M16	M20	M24
Combine	d pullout and conci	rete con	e failure				
Calculation	on diameter	d	[mm]	12	16	20	25
Uncracke	ed concrete						
Characte	ristic bond resistan	ce in un	cracked	concrete C20/25	5		
<u>Hammer-</u>	drilling with standard	drill bit c	r hollow d	rill bit (dry or wet	t concrete)		
Tem-	I: 35 °C / 60 °C		[N]/mm21	15	14	13	12
perature range	II: 50 °C / 72 °C	τRk,ucr	[N/mm ²]	14	13	12	12
<u>Hammer-</u>	drilling with standard	drill bit c	r hollow d	Irill bit (water fille	d hole)		
Tem-	I: 35 °C / 60 °C		FN.1/ 27	14	12	11	10
perature range	II: 50 °C / 72 °C	τRk,ucr	[N/mm²]	13	12	11	9
Diamond-	drilling (dry or wet co	ncrete a	s well as v	water filled hole)			
Tem-	I: 35 °C / 60 °C			13	12	10	9
perature range	II: 50 °C / 72 °C	τRk,ucr	[N/mm²]	12	11	10	9
	on factors				1		
Dry or we	t concrete				1	,0	
Water fille	ed hole	γinst	[-]		1	,4	
Cracked	concrete						
Characte	ristic bond resistan	ce in cr	acked co	ncrete C20/25			
<u>Hammer-</u>	<u>drilling with standard</u>	drill bit c	r hollow d	rill bit and diamo	nd-drilling (dry o	r wet concrete)	
Tem-	I: 35 °C / 60 °C		[N]/mm21	8	8	8	8
perature range	II: 50 °C / 72 °C	TRk,cr	[N/mm²]	8	8	8	8
<u>Hammer-</u>	drilling with standard	drill bit c	r hollow d	rill bit and diamo	nd-drilling (water	filled hole)	
Tem-	I: 35 °C / 60 °C		[N1/ 07	7	6	6	6
perature range	II: 50 °C / 72 °C	TRk,cr	[N/mm²]	7	6	6	6
	on factors						
Dry or we	t concrete		[]		1	,0	
Water fille	ed hole	γinst	[-]	1	,2	1,	4

fischer injection system FIS EM Plus	
Performance	Annex C 11
Essential characteristics of tensile resistance for fischer rebar anchors FRA; service life time 50 years	

Table C12.1: Essential characteristics of tensile resistance for fischer rebar anchors FRA in hammer or diamond drilled holes; uncracked or cracked concrete; service life time 100 years

fischer re	bar anchor FRA			M12	M16	M20	M24
Combined	d pullout and cond	rete con	e failure				
Calculation	n diameter	d	[mm]	12	16	20	25
Uncracke	d concrete						
Character	istic bond resista	nce in un	cracked	concrete C20/25	5		
Hammer-c	Irilling with standard	d drill bit o	r hollow d	Irill bit (dry or wet	concrete)		
Tem-	I: 35 °C / 60 °C		5N.17 27	15	14	13	12
perature range	II: 50 °C / 72 °C	TRk,ucr	[N/mm²]	14	13	12	12
Diamond-o	drilling (dry or wet c	oncrete)			•	•	
Tem-	I: 35 °C / 60 °C		FA.17 07	13	12	10	9
perature range	II: 50 °C / 72 °C	TRk,ucr	[N/mm²]	12	11	10	9
Installatio	n factors		•		•		
Dry or wet	concrete	γinst	[-]		1	,0	
Service	I: 35 °C / 60 °C		[N.17]	0,75	0,75	0,75	0,75
life time 100 years	II: 50 °C / 72 °C	—α _{100 years}	[N/mm²]	0,60	0,65	0,65	0,65
Cracked o	oncrete						-
Character	istic bond resista	nce in cra	acked co	ncrete C20/25			
Hammer-c	Irilling with standard	d drill bit o	r hollow d	rill bit and diamo	nd-drilling (dry o	r wet concrete)	
Tem-	I: 35 °C / 60 °C		[N 1/ 2]	8	8	8	8
perature range	II: 50 °C / 72 °C	TRk,cr	[N/mm²]	8	8	8	8
Installatio	n factors						
Dry or wet	concrete	γinst	[-]		1	,0	
Service	I: 35 °C / 60 °C			0,80	0,65	0,65	0,65
life time 100 years	II: 50 °C / 72 °C	—α _{100 years}	[-]	0,80	0,65	0,65	0,65

$^{1)}$ Calculation of characteristic bond resistance in uncracked concrete $\tau_{\text{Rk},100\,\text{years},\text{ucr}}$:

 $\tau_{\text{Rk,100 years,ucr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,ucr}}$

$^{2)}$ Calculation of characteristic bond resistance in cracked concrete $\tau_{\text{Rk},100\;\text{years,cr}}$:

 $\tau_{\text{Rk,100 years,cr}} = \alpha_{\text{100 years}} \cdot \tau_{\text{Rk,cr}}$

fischer injection system FIS EM Plus	
Performance Essential characteristics of tensile resistance for fischer rebar anchors FRA; service life time 100 years	Annex C 12

Table (C13.1: Dis	placem	ents for	ancho	r rods						
Anchor	rod	M8	M10	M12	M14	M16	M20	M22	M24	M27	M30
Displace	ement-Factors	for tensi	le load ¹⁾								
Uncrack	ed or cracked	concrete	; Tempe	rature ra	nge I, II						
δ _{N0-Factor}	[mm/(N/mm²)]	0,07	0,08	0,09	0,09	0,10	0,11	0,11	0,12	0,12	0,13
δN∞-Factor	[[[[[[]]	0,11	0,12	0,13	0,14	0,15	0,16	0,17	0,18	0,19	0,19
Displace	ement-Factors	for shea	r load ²⁾								
Uncrack	ed or cracked	concrete	; Tempe	rature ra	nge I, II						
δ V0-Factor	[mm/kN]]	0,18	0,15	0,12	0,10	0,09	0,07	0,07	0,06	0,05	0,05
δv∞-Factor	[mm/kN]	0,27	0,22	0,18	0,16	0,14	0,11	0,10	0,09	0,08	0,07

1) Calculation of effective displacement:

2) Calculation of effective displacement:

 $\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau_{\text{Ed}}$

 $\delta v_0 = \delta v_0\text{-Factor} \cdot V_{\text{Ed}}$

 $\delta_{\text{N}\infty} = \delta_{\text{N}\infty\text{-Factor}} \cdot \tau_{\text{Ed}}$

 $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V_{Ed}$

(τ_{Ed}: Design value of the applied tensile stress)

(V_{Ed}: Design value of the applied shear force)

Table C13.2: Displacements for fischer internal threaded anchors RG MI

Internal anchor F	threaded RG MI	M8	M10	M12	M16	M20
Displace	ement-Factors	for tensile load1)				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
δ _{N0} -Factor	[mm//N/mm2)]	0,09	0,10	0,10	0,11	0,13
δ _{N∞-Factor}	[mm/(N/mm²)]	0,13	0,15	0,16	0,17	0,19
Displace	ment-Factors	for shear load ²⁾				
Uncrack	ed or cracked	concrete; Tempe	rature range I, II			
δvo-Factor	[0,12	0,09	0,08	0,07	0,05
δv∞-Factor	[mm/kN]	0,18	0,14	0,12	0,10	0,08

1) Calculation of effective displacement:

2) Calculation of effective displacement:

 $\delta_{\text{N0}} = \delta_{\text{N0-Factor}} \cdot \tau_{\text{Ed}}$

 $\delta_{V0} = \delta_{V0\text{-Factor}} \cdot V_{Ed}$

 $\delta_{\text{N}\infty} = \delta_{\text{N}\infty\text{-Factor}} \cdot \tau_{\text{Ed}}$

 $\delta_{V\infty} = \delta_{V\infty\text{-Factor}} \cdot V_{Ed}$

(τ_{Ed}: Design value of the applied tensile stress)

(V_{Ed}: Design value of the applied shear force)

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Performance

Displacements for anchor rods and fischer internal threaded anchors RG MI

of the ba	diameter or ф	8	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40
	ment-Factors	for te	ensile	load	1)													
Uncrack	ed or cracked	cond	rete;	Temp	erat	ure ra	ange	I, II										
N0-Factor	[mm/(N/mm²)	0,07	0,08	0,09	0,09	0,10	0,10	0,11	0,11	0,12	0,12	0,12	0,13	0,13	0,13	0,14	0,14	0,15
N∞-Factor	[IIIII/(IN/IIIII=) 	0,11	0,12	0,13	0,14	0,15	0,16	0,16	0,17	0,18	0,18	0,18	0,19	0,19	0,20	0,20	0,21	0,22
Displace	ment-Factors	for s	hear l	oad ²⁾														
Incrack	ed or cracked	_						_										
V0-Factor	[mm/kN]	_	0,15	-		_	_		_	_	_	_	_	_	_			_
V∞-Factor	[0,27	0,22	0,18	0,16	0,14	0,12	0,11	0,10	0,09	0,09	0,08	0,08	0,07	0,07	0,06	0,06	0,05
1) Calcu	lation of effec	tive dis	splace	ment	:			2) (Calcul	ation	of effe	ective	displ	acem	ent:			
δΝ0 =	$\delta \text{N0-Factor}$ ' τEd							8	δ vo = δ	V0-Fact	tor · VE	Ēd						
	$\delta_{\text{N}\infty\text{-Factor}}$. τ_{Ed}								$\delta_{V\infty} = \delta$									
(τ _{Ed} : l	Design value o	of the a	applied	d tens	sile st	ress)		(V _{Ed} : [Desigi	า valu	e of t	he ap	plied	shea	force	e)	
Table (C14.2: Dis	splac	eme	nts f	or fi s	sche	er rel	bar a	anch	ors	FRA							
scher r RA	ebar anchor		М	12				M16				M20)			M2	24	
isplace	ment-Factors	for te	ensile	load	1)													
Jncrack	ed or cracked	cond	rete;	Temp	oerat	ure ra	ange	I, II										
			0,	09				0,10				0,11				0,1	2	
N0-Factor	[mm/(N/mm ²)	1⊢——								- 1		0,16				0,1	8	
	[mm/(N/mm²)		0,	13				0,15				0,10				0, 1		
N∞-Factor Displace	ment-Factors	for s	hear l	oad ²⁾								0,10				0,1	0	
N∞-Factor Displace Jncrack		for s	hear l rete;	oad ²⁾ Temp		ure ra	ange	I, II										
N∞-Factor Pisplace Incrack V0-Factor	ement-Factors	for s	hear l rete;	oad ²⁾ Temp 12		ure ra	ange	I, II 0,09				0,07				0,0	06	
N∞-Factor Displace Uncrack V0-Factor	ment-Factors	for s	hear l rete;	oad ²⁾ Temp		ure ra	ange	I, II									06	
N∞-Factor Displace Jncrack V0-Factor V∞-Factor	ement-Factors	for s	hear lerete;	load ²⁾ Temp 12 18	perat	ure ra	ange	I, II 0,09	²⁾ Cal	culati	on of	0,07	,	isplac	cemer	0,0	06	
Displace Jncrack V0-Factor 1) Calcut δN0 =	ment-Factors ed or cracked [mm/kN] slation of effect δNO-Factor · τEd	for s	hear lerete;	load ²⁾ Temp 12 18	perat	ure ra	ange	I, II 0,09	δνο	= δvo	-Factor	0,07 0,11 effec	,	isplac	cemer	0,0	06	
Displace Jncrack Ov-Factor Ov-Factor Ov-Factor Ov-Factor No = δNo = δNo =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Uncrack $\delta_{V0}\text{-Factor}$ $\delta_{V\infty}\text{-Factor}$ 1) Calcu $\delta_{N0} =$ $\delta_{N\infty} =$	ment-Factors ed or cracked [mm/kN] slation of effect δNO-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d	isplace appl		0,0 0,0 nt:	06	
ÖN∞-Factor Displace Uncrack ÖV0-Factor ÖV∞-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack V0-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack V0-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack V0-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack V0-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
N∞-Factor Displace Jncrack V0-Factor V∞-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack V0-Factor 1) Calcu δN0 = δN∞ =	ement-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack V0-Factor 1) Calcu δN0 = δN∞ =	ment-Factors ed or cracked [mm/kN] Ilation of effect δN0-Factor · τEd δΝ∞-Factor · τEd	s for s	hear I	Temp 12 18 ment	perat		ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack ivo-Factor ivo-Factor 1) Calcu δNo = (τEd: I	ed or cracked [mm/kN] Ilation of effect δNo-Factor · τEd δN∞-Factor value of the control of th	s for s	hear I	Temp 12 18 ment	: sile st	ress)	ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d			0,0 0,0 nt:	06	
Displace Jncrack Ovo-Factor 1) Calcu δνο = δνω = (τεd: I	ment-Factors ed or cracked [mm/kN] slation of effect δNo-Factor · τEd δNω-Factor · τEd Design value of	s for s	hear I	Temp 12 18 ment	: sile st	ress)	ange	I, II 0,09	δνο δν∞	$= \delta v_0$ $= \delta v_0$)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d		ied sh	0,0 0,0 nt:	06 09 orce)	
Displace Jncrack Ove-Factor Ove-Factor Calcuston No = δνω = (τEd: I	ment-Factors ed or cracked [mm/kN] slation of effect δNo-Factor · τEd δNω-Factor · τEd Design value of	s for s	hear I crete; 0, 0, splace	Temp 12 18 ement d tens	: Sile st	ress)	ange	I, II 0,09 0,14	δνο δν∞ (Vε	= δνα = δνα Ed: De)-Factor ∞-Factor	0,07 0,11 effec · V _{Ed} · V _{Ed}	tive d		ied sh	0,0 0,0 nt:	06	

Table C15.1: Essential characteristics²⁾ for the **steel bearing capacity** under tensile / shear load of **fischer anchor rods** and **standard threaded rods** under seismic action performance category C1 or C2

		10 4011011 p	0110	mai	100 0a								
Anch	or rod / standard th	readed rod			M10	M12	M14	M16	M20	M22	M24	M27	M30
Beari	ng capacity under to	ensile load,	stee	el failu	ure ¹⁾								
fische	er anchor rods and	standard th	read	ed ro	ds, per	forman	ce cate	egory C	1				
ic re-	Steel zinc plated		5.8		29(27)	43	58	79	123	152	177	230	281
erstic N _{RK,s,e}	Steer zinc plated		8.8		47(43)	68	92	126	196	243	282	368	449
e Z	Stainless steel A4	Property class	50	[kN]	29	43	58	79	123	152	177	230	281
Characterstic resistance NRK, s, eq. c	and high corrosion	o la so	70		41	59	81	110	172	212	247	322	393
Ch sist	resistant steel C		80		47	68	92	126	196	243	282	368	449
fische	er anchor rods and	standard th	read	ed ro	ds, per	forman	ce cate	gory C	2				
; re- ,eq,C2	Steel zinc plated		5.8		-	39	-	72	108	-	177	-	-
10 0	Steer zinc plated		8.8		-	61	-	116	173	-	282	-	-
ctersti e N _{RK}	Stainless steel A4	Property class	50	[-]	-	39	-	72	108	-	177	-	-
Charact sistance	and high corrosion	o a do	70		-	53	ı	101	152	-	247	1	-
Sist	resistant steel C		80		-	61	1	116	173	-	282	-	-
Beari	ng capacity under s	hear load,	steel	failu	re with	out leve	er arm ¹)					
fische	er anchor rods, perf	ormance ca	atego	ory C	f								
6 - g,C1	Ctaal zina platad		5.8		15(13)	21	29	39	61	76	89	115	141
terstic re- V ⁰ Rk,s,eq,(Steel zinc plated		8.8		23(21)	34	46	63	98	122	141	184	225
Characterstic resistance Vork, s, eq. C	Stainless steel A4	Property class	50	[kN]	15	21	29	39	61	76	89	115	141
Charact sistance	and high corrosion	Ciass	70		20	30	40	55	86	107	124	161	197
Ch Sista	resistant steel C		80		23	34	46	63	98	122	141	184	225
Stand	lard threaded rods,	performand	се са	tegoi	y C1								
re-	Stool zine plated		5.8		11(9)	15	20	27	43	53	62	81	99
Terstic I	Steel zinc plated		8.8		16(14)	24	32	44	69	85	99	129	158
ters V°	Stainless steel A4	Property class	50	[kN]	11	15	20	27	43	53	62	81	99
Characterstic restance Vork, s, eq. C	and high corrosion	Olass	70		14	21	28	39	60	75	87	113	138
Charact sistance	resistant steel C		80		16	24	32	44	69	85	99	129	158
	er anchor rods and	standard th	read	ed ro	ds, per	forman	ce cate	egory C	2				
.e -	Stool zing plated		5.8		_	14	_	27	43	-	62	-	-
terstic re- V ⁰ Rk,s,eq,C	Steel zinc plated		8.8		-	22		44	69		99	-	
ters V°	Stainless steel A4	Property class	50	[-]	-	14	-	27	43	-	62	-	-
Characterstic resistance Vork, s, eq, c	and high corrosion	Jugg	70		-	20	-	39	60	-	87	ı	-
Ch sista	resistant steel C		80		-	22	-	44	69	-	99	-	-

¹⁾ Partial factors for performance category C1 or C2 see table C16.2; for fischer anchor rods FIS A / RGM the factor for steel ductility is 1,0

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Essential characteristics for the steel bearing capacity for fischer anchor rods and standard threaded rods under seismic action (performance category C1 / C2)

²⁾ Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot dip galvanized standard threaded rods according to EN ISO 10684:2004+AC:2009.

Table C16.1: Essential characteristics for the **steel bearing capacity** under tensile / shear load of **reinforcing bars (B500B)** under seismic action performance category **C1**

Bearing capacity under shear load, steel failure without lever arm1)

Reinforcing bar B500B acc. to DIN 488-2:2009-08, performance category C1

Characterstic resistance V⁰Rk,s,eq,C1 [KN] 15 | 22 | 30 | 39 | 49 | 61 | 74 | 88 | 95 | 102 | 119 | 137 | 155

Table C16.2: Partial factors for fischer anchor rods, standard threaded rods and reinforcing bars (B500B) under seismic action performance category C1 or C2

Anch	or rod / standard th	readed rod			M10	N	/ 112	M14	М	16	M20	M2	22	M24	M2	7 1	M30
Nomi	inal diameter of the l	bar		ф	10	12	14	16	18	20	22	24	25	26	28	30	32
Tens	ile load, steel failure	1)															
7	Ctool =ino mlotod		5.8								1,50						
YMs,I	Steel zinc plated		8.8								1,50						
tor	Stainless steel A4	Property class	50								2,86						
Partial factor γ _{Ms,N}	and high corrosion	Class	70	[-]						1,5	02) / 1	,87					
artig	resistant steel C		80		1,60												
"	Reinforcing bar	B!	500B		1,40												
Shea	r load, steel failure ¹⁾																
>	Ctool zine plated		5.8								1,25						
YMs,	Steel zinc plated	 _	8.8								1,25						
ctor	Stainless steel A4	Property class	50	r 1							2,38						
al fa	and high corrosion	ola o o	70	[-]						1,2	:5 ²⁾ / 1	,56					
Partial factor y _{Ms,v}	resistant steel C		80								1,33						
	Reinforcing bar	B!	500B								1,50						

¹⁾ In absence of other national regulations

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Essential characteristics for the steel bearing capacity for reinforcing bars under seismic action (performance category C1); partial safety factors (performance category C1 / C2)

¹⁾ Partial factors for performance category C1 see table C16.2

²⁾ Only admissible for high corrosion resistant steel C, with f_{yk} / $f_{uk} \ge 0.8$ and $A_5 > 12$ % (e.g. fischer anchor rods)

range II: 50 °C / 72 °C Hammer-drilling with standard drill bit or Temperature II: 35 °C / 60 °C Temperature III: 50 °C / 72 °C Installation factors tensile load Dry or wet concrete Water filled hole shear load	r hollo	7,0 7,0	and c ill bit 7 7 ill bit	,0 ,0	6,7 6,7	6 5	,0 ,7 ,7 nole)		6, 6,	7 7	6,7 6,7	6,7 6,7	7	M30 6,7
Hammer-drilling with standard drill bit of the perature range I: 35 °C / 60 °C TRK,eq,C1 [N/t] Hammer-drilling with standard drill bit of the perature range I: 35 °C / 60 °C TRK,eq,C1 [N/t] Temperature range I: 35 °C / 60 °C TRK,eq,C1 [N/t] Installation factors tensile load Dry or wet concrete Water filled hole Shear load	r hollo	7,0 7,0 7,0 ow dr 7,5	7 7 ill bit	,0 ,0 ,0 ;(wa	6,7 6,7 ter fi	6 5	,0 ,7 ,7 nole)	5,7 5,7	6,	7	6,7	-	_	6,7
Temperature range I: 35 °C / 60 °C TRK,eq,C1 [N/r] Hammer-drilling with standard drill bit of the perature range II: 35 °C / 60 °C TRK,eq,C1 [N/r] Temperature range II: 50 °C / 72 °C TRK,eq,C1 [N/r] Installation factors tensile load Dry or wet concrete Water filled hole Shear load	r hollo	7,0 7,0 ow dr 7,5	7 7 ill bit	,0 ,0 : (wa ,5	6,7 6,7 ter fi 6,5	5 5	,0 ,7 nole)	5,7 5,7	6,	7	6,7	-	_	6,7
perature range II: 50 °C / 72 °C TRk,eq,C1 [N/I	r holic	7,0 ow dr 7,5	7 ill bit	,0 : (wa ,5	6,7 ter fi 6,5	5 lled h	,7 nole)	5,7	6,	7	6,7	-	_	6,7
range II: 50 °C / 72 °C Hammer-drilling with standard drill bit or Temperature range II: 35 °C / 60 °C / 72 °C Installation factors tensile load Dry or wet concrete Water filled hole shear load	r holic	7 ,5	ill bit	; (wa	ter fi 6,5	lled h	nole) ,7	,	1 '			6,7	7	
Temperature range I: 35 °C / 60 °C II: 50 °C / 72 °C TRK,eq,C1 [N/IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	mm²] -	7,5	7	,5	6,5	5	,7	5,7	5,	-			-	6,7
perature range II: 50 °C / 72 °C TRk,eq,C1 [N/I			_					5,7	5,	,				
range II: 50 °C / 72 °C Installation factors tensile load Dry or wet concrete Water filled hole shear load		6,8	6	,8	6,5	5				/	5,7	5,7	7	5,7
Installation factors tensile load Dry or wet concrete Water filled hole shear load	[-]						,7	5,7	5,	7	5,7	5,7	7	5,7
Dry or wet concrete Water filled hole shear load	[-]									-				
Water filled hole shear load	[-]													
Water filled hole shear load	[-]							1,0						
				1,:	2						1,4			
All installation conditions γ _{inst}														
	[-]							1,0						
drilled holes under s time 50 and 100 ye Nominal diameter of the bar				14	16	18	20	22	24	25	26	28	30	32
Characteristic bond resistance, combine	-		$\overline{}$											<u> </u>
Hammer-drilling with standard drill bit o														
Tem- I: 35 °C / 60 °C				6,7	5,7	5,7	5,7	6,7	6,7	6,7	6,7	0 -		Τ.,
perature TRK,eq,C1 [N/I range II: 50 °C / 72 °C	mm²]	-	-+	6,7	5,7	5,7	5,7	- /	- ,		1 0.7 1	6./	6.7	4.8
	r holld							6,7	6,7	6,7	- -	6,7 6,7	6,7 6,7	
Hammer-drilling with standard drill bit o				: (wa	ter fil	lled h		6,7	6,7	6,7	6,7	6,7	6,7	4,8
Hammer-drilling with standard drill bit on Tem- 1: 35 °C / 60 °C		7.5					ole)		,		6,7	6,7	6,7	4,8
Tem- I: 35 °C / 60 °C perature	mm²]	-	6,5	6,5	5,7	5,7	5 ,7	5,7	5,7	5,7	5,7	5,7	6,7 5,7	4,8
Tem- I: 35 °C / 60 °C perature II: 50 °C / 72 °C TRk,eq,C1 [N/I			6,5				ole)		,		6,7	6,7	6,7	4,8
Tem- I: $35 ^{\circ}\text{C} / 60 ^{\circ}\text{C}$ perature range II: $50 ^{\circ}\text{C} / 72 ^{\circ}\text{C}$ TRK,eq,C1 Installation factors			6,5	6,5	5,7	5,7	5 ,7	5,7	5,7	5,7	5,7	5,7	6,7 5,7	4,8
Tem- perature I: 35 °C / 60 °C range II: 50 °C / 72 °C Installation factors Tensile load Dry or wet concrete	mm²] -		6,5	6,5	5,7	5,7	5 ,7	5,7	5,7	5,7	5,7	5,7	6,7 5,7	4,8
Tem- perature I: 35 °C / 60 °C range II: 50 °C / 72 °C Installation factors Tensile load Dry or wet concrete			6,5 6,5	6,5	5,7	5,7	5 ,7	5,7	5,7	5,7	5,7	5,7	6,7 5,7	4,8
Tem- perature I: 35 °C / 60 °C perature II: 50 °C / 72 °C Installation factors Tensile load Dry or wet concrete	mm²] -		6,5 6,5	6,5 5,8	5,7	5,7	5 ,7	5,7	5,7	5,7	5,7 5,7	5,7	6,7 5,7	4,8

Table C18.1: Essential characteristics of resistance for fischer anchor rods and standard threaded rods in hammer drilled holes under seismic action performance category C2; service life time 50 and 100 years

Anchor rod / s	tandard thread	ed rod		M12	M16	M20	M24
Characteristic	bond resistand	e, com	bined pu	lout and concre	ete cone failure		
Hammer-drillin	ıg with standar	d drill b	oit or holle	ow drill bit (dry	or wet concrete	e)	
	35 °C / 60 °C		[N 1 /rea rea 2]	3,5	5,8	5,0	3,1
perature —— range II: 5	50 °C / 72 °C	TRk,eq,C2	[N/mm²]	3,3	5,5	4,7	2,9
Hammer-drillin	ıg with standar	d drill b	oit or holl	ow drill bit (wat	er filled hole)		
	35 °C / 60 °C		[N]/www.27	3,5	5,8	5,0	3,1
perature —— range II: 5	50 °C / 72 °C	TRk,eq,C2	[N/mm²]	3,3	5,5	4,7	2,9
Installation fac	tors						
Tensile load							
Ory or wet conc	rete				1	,0	
Water filled hole	9	γinst	[-]	1	,2	1.	,4
Shear load							
All installation c	onditions	γinst	[-]		1	,0	
Displacement-	Factors for ten	sile loa	d ¹⁾				
N,(DLS)-Factor		[mm/	/(N/mm²)]	0,09	0,10	0,11	0,12
ŠN,(ULS)-Factor		[IIIIII/	(14/111111-)]	0,15	0,17	0,17	0,18
Displacement-	Factors for she	ear load	l ²⁾				
δV,(DLS)-Factor			ım/kN]	0,18	0,10	0,07	0,06
δ V,(ULS)-Factor			IIII/KINJ	0,25	0,14	0,11	0,09

¹⁾ Calculation of effective displacement:

 $\delta_{\text{N,(DLS)}} = \delta_{\text{N,(DLS)-Factor}} \cdot \tau_{\text{Ed}}$

 $\delta_{\text{N,(ULS)}} = \delta_{\text{N,(ULS)-Factor}} \cdot \tau_{\text{Ed}}$

 $(\tau_{Ed}$: Design value of the applied tensile stress)

2) Calculation of effective displacement:

 $\delta_{\text{V,(DLS)}} = \delta_{\text{V,(DLS)-Factor}} \cdot V_{\text{Ed}}$

 $\delta_{V,(\text{ULS})} = \delta_{V,(\text{ULS})\text{-Factor}} \cdot V_{\text{Ed}}$

(V_{Ed}: Design value of the applied shear force)

fischer injection system FIS EM Plus

Essential characteristics under seismic action (performance category C2) for fischer anchor rods and standard threaded rods; service life time 50 and 100 years